Delta Smelt Turbidity Monitoring Project

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Why the Delta Smelt?

Hypomesus transpacificus
(Delta Smelt)

Unusual-Life History:

Indicator Species

- Most live only one-year.
- Females only produce between 1000 and 2600 eggs.
- Ultimately the delta smelt persists by maximizing growth, survival, and reproduction on an annual basis despite all the environmental and human factors that exist in the Sacramento-San Joaquin Delta.
- Spawning occurs in narrow temperature range (15-20°C).

Project Background

- **August. 21-24 and 29-31, 2007 Evidentiary Hearing:**

- **Federal Judge Oliver Wanger ruled (case number 1:05-CV-01207-OWW-GSA):**

Natural Resources Defense Council, et al.

vs.

Dirk Kempthorne (Secretary of the Interior), et al.,

Court Findings:

- 2005 Long-Term State and Federal Water Projects' Pumping Operations Criteria Plan (OCAP) and Biological Opinion.

Unlawful and inadequate in regards to the protection of the threatened species delta smelt.

- Delta Smelt Risk Assessment Matrix (DSRAM) was in ***violation of the Administrative Procedure Act, 5 U.S.C. § 705 et seq.***

Project Background continued…

Court Remedies:

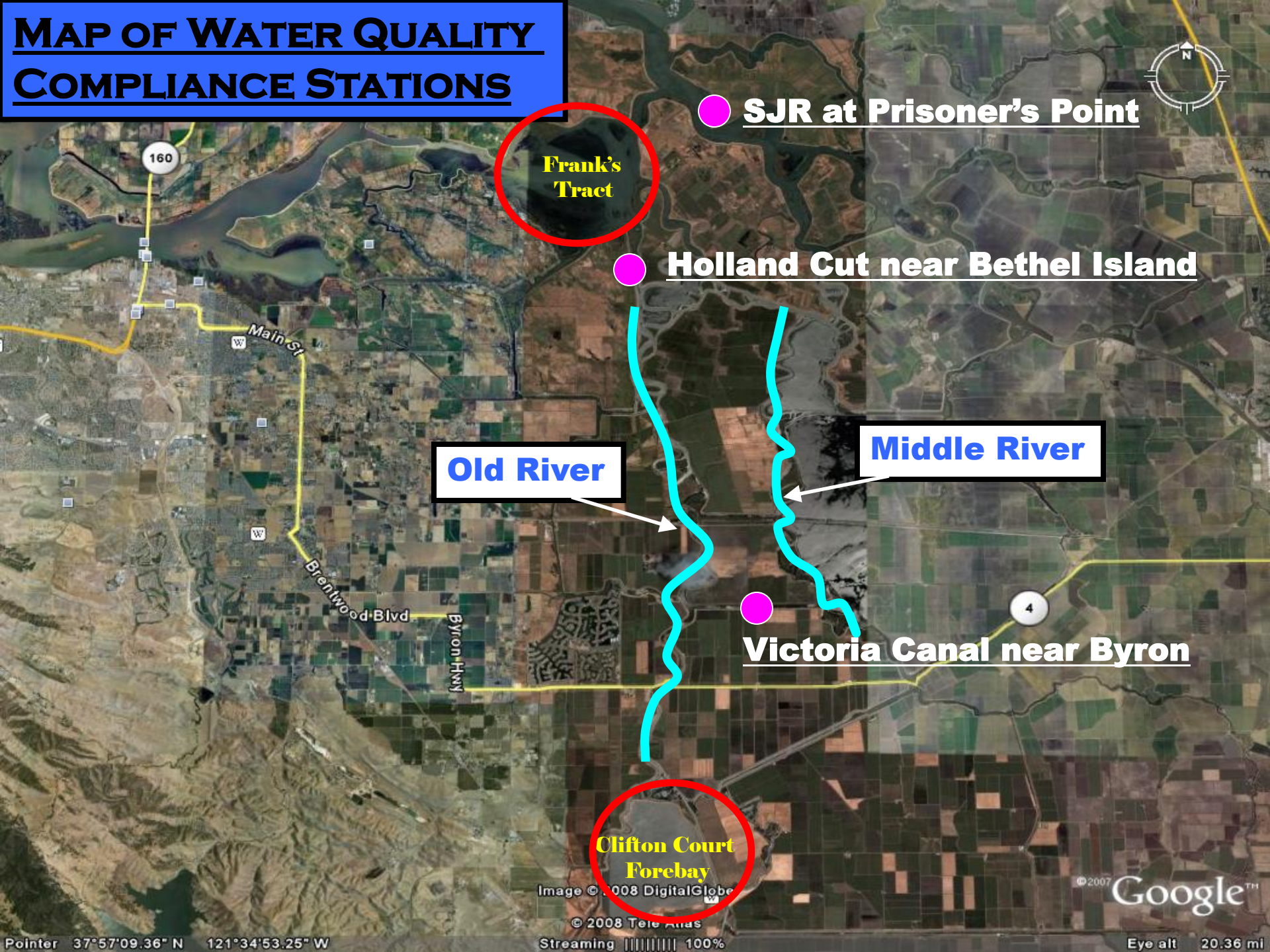
- Establishment of several measures that would trigger restrictions to both State Water Project and Central Valley Project water export operations to reduce salvage and prevent the extinction of delta smelt.

Included in those triggers…

Turbidity and Export Pumping Compliance Criteria

As a result of the scientific evidence provided in court, Judge Wanger included in his measures, the requirement to monitor turbidity levels by December 25, 2007 at three compliance stations:

1. **Holland Cut near Bethel Island**
2. **Victoria Canal near Byron**
3. **San Joaquin River at Prisoner's Point**


Map of Water Quality Compliance Stations
SJR at Prisoner's Point
Frank's Tract
Holland Cut near Bethel Island
Old River
Middle River
Victoria Canal near Byron
Clifton Court Forebay
160
Main St
Brentwood Blvd
Byron Hwy
4
N
Image © 2008 DigitalGlobe
© 2008 Tele Atlas
©2007 Google
Pointer 37°57'09.36" N 121°34'53.25" W
Streaming 100%
Eye alt 20.36 mi

Turbidity and Export Pumping Compliance Criteria

If the turbidity levels at anyone of these stations exceeds 12 NTU, after December 25th.

1. Holland Cut near Bethel Island (HOL)
2. Victoria Canal near Byron (VCU)
3. San Joaquin River at Prisoner's Point (PPT)

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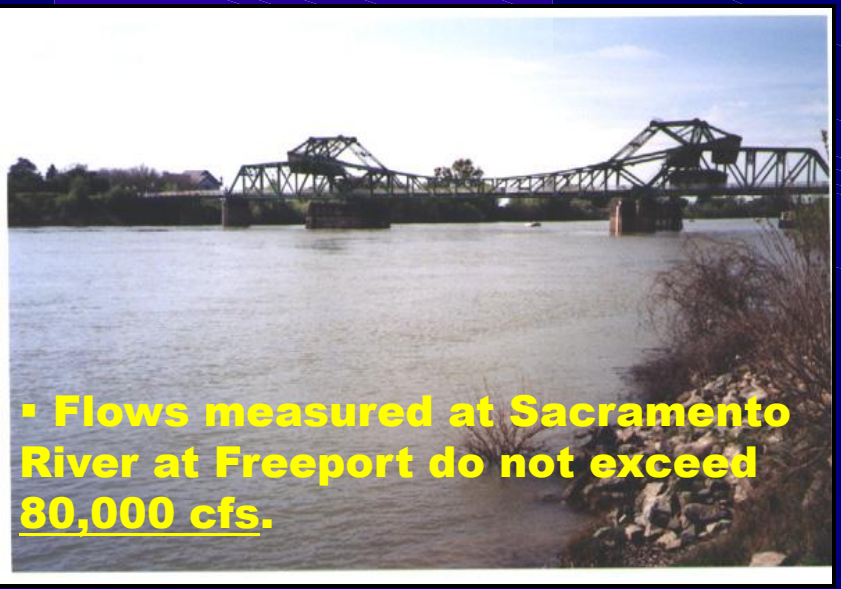

- Flows measured at Sacramento River at Freeport do not exceed 80,000 cfs.

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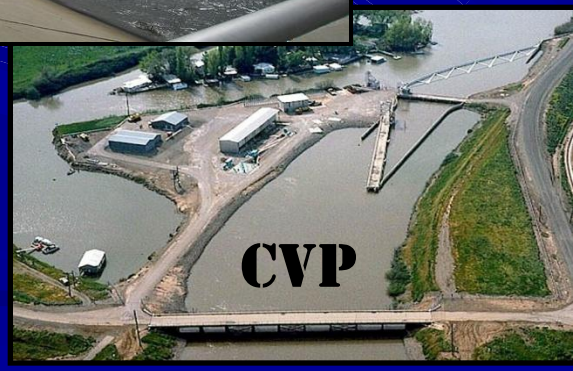


To insure net upstream Old and Middle River flows are < 2,000 cfs.

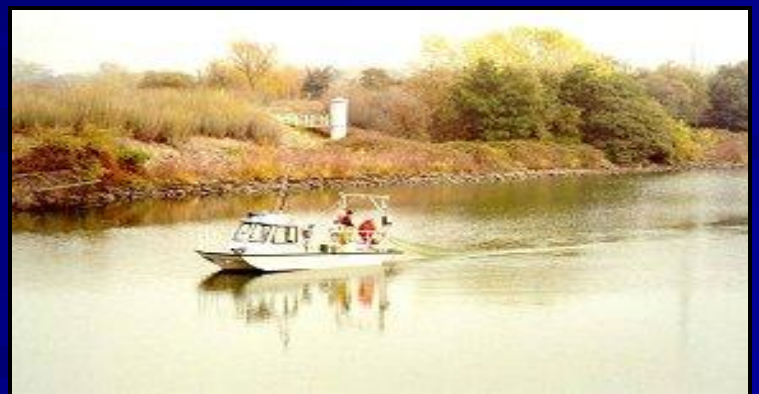
Turbidity and Export Pumping Compliance Criteria continued…

THE PUMPING RESTRICTION CAN BE TERMINATED IF ANYONE OF THESE THREE FACTORS EXIST:

1. **The three-day average of flow in the Sacramento River at Freeport exceeds 80,000 cfs.**

2. **The Spring Kodiak Trawl survey or export facilities show the presence of spent female delta smelt.**

3. **The larval delta smelt are recovered at either the Federal (CVP) or State Water (SWP) export salvage facility or recovered during the California Department of Fish and Game's 20mm survey.**



Project Objectives

1. To address Judge Wanger's written order of turbidity compliance at stations:

- Holland Cut near Bethel Island
- Victoria Canal near Byron
- San Joaquin River at Prisoner's Point

2. Guide and coordinate the development of a complex network of continuous water quality stations that will provide information as it relates to the survival and movement of delta smelt.

3. Establish a historical collection of accurate continuous water quality data that can be used for future model studies.

Overall Objective

➢ It is anticipated that the data gathered from this project will help State and Federal water managers better understand delta smelt populations to minimize possible entrainment and salvage as a result of water export operations.

Water Quality Equipment

CR1000 Datalogger

Raven AirLink Cellular Modem

→ **CDEC**

YSI 6136
Optical Turbidity Sensor

YSI

Range:	Accuracy:
0 – 1,000 NTU	± 0.3 NTU

QA/QC Process

YSI Sonde Calibrations

Hydstra.hk

WDL

Water Data Library

Discrete Monitoring

2100P Portable Turbidimeter

CDEC

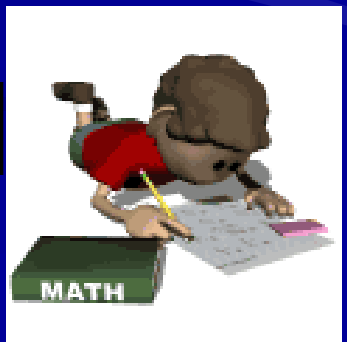
California Data Exchange Center

Real-Time Event / Hourly Data

Project Response QA/QC Protocols

- ✓ STEP 1
- ✓ STEP 2
- ✓ STEP 3
- ✓ STEP 4

Turbidity Statistical Outlier Identification Procedure



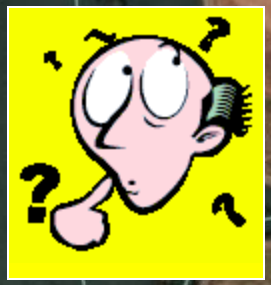
Significant Findings

➢ Wind/Storm Event December 24 – 25, 2007

- HOL turbidity levels were averaging 6.06 NTU for the month of December, but levels changed dramatically by December 25 with a daily average of 19.05 NTU
- Turbidity levels rose above the court ordered value of 12 NTU and reached a maximum value of 66.4 NTU.
- This triggered a curtailment of pumping for 10 days

Central District and USGS staff took a closer look at Frank's Tract

What else could have contributed to the high turbidity levels on December 25th?



1. WT ↓ = Bio-activity ↓ :during the late fall and early winter.

- **This provides bottom sediment stability and sediment filtration.**

2. Fall/Winter estuary wind and tidal conditions in Sacramento-San Joaquin Delta are typically associated with weak winds and weak tides, therefore allowing for sediments to settle to the bottom and accumulate.

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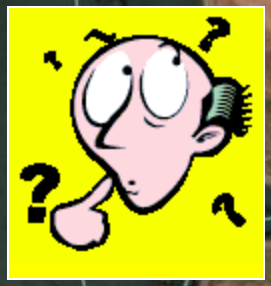

3. On December 24th and 25th, Sacramento–San Joaquin Delta was experiencing **strong tides (solstice).**

- This contributes to **greater turbidity levels** and allow turbidity levels to **persist for longer** periods of time.

4. **Franks Tract** is an **expansive, shallow** water body with **low currents**, providing **ideal** conditions for **sediment deposition**.

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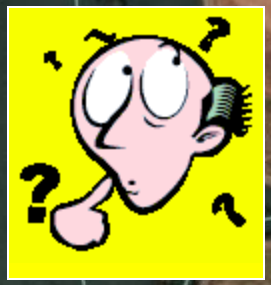
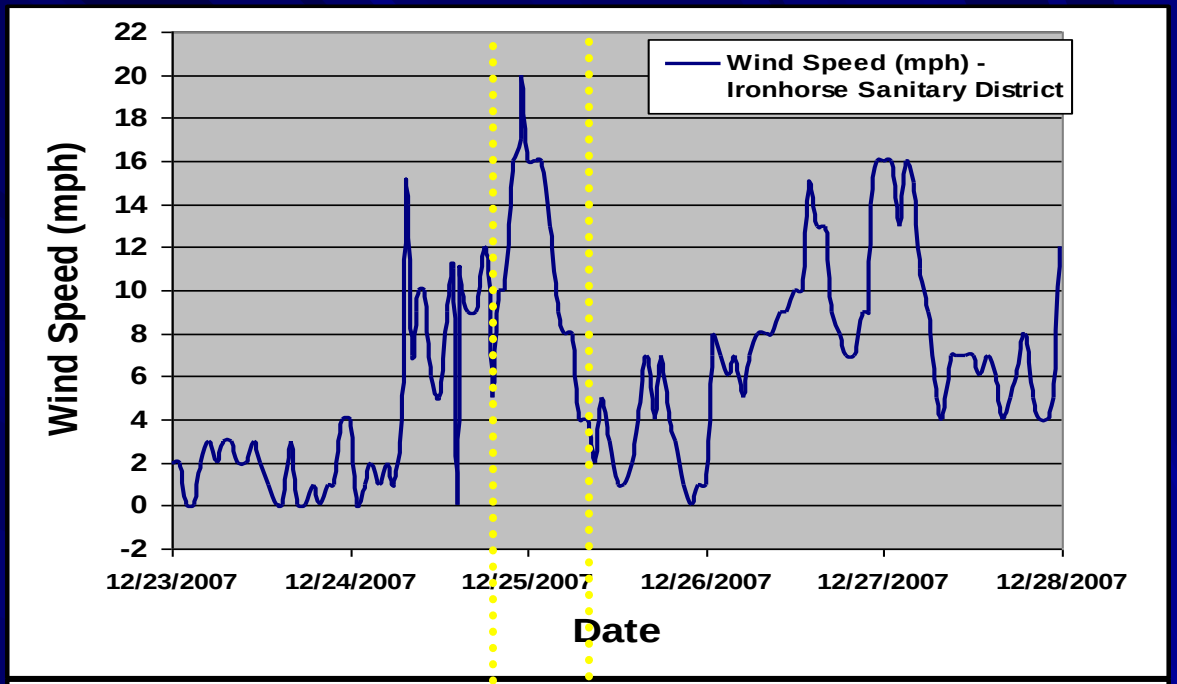


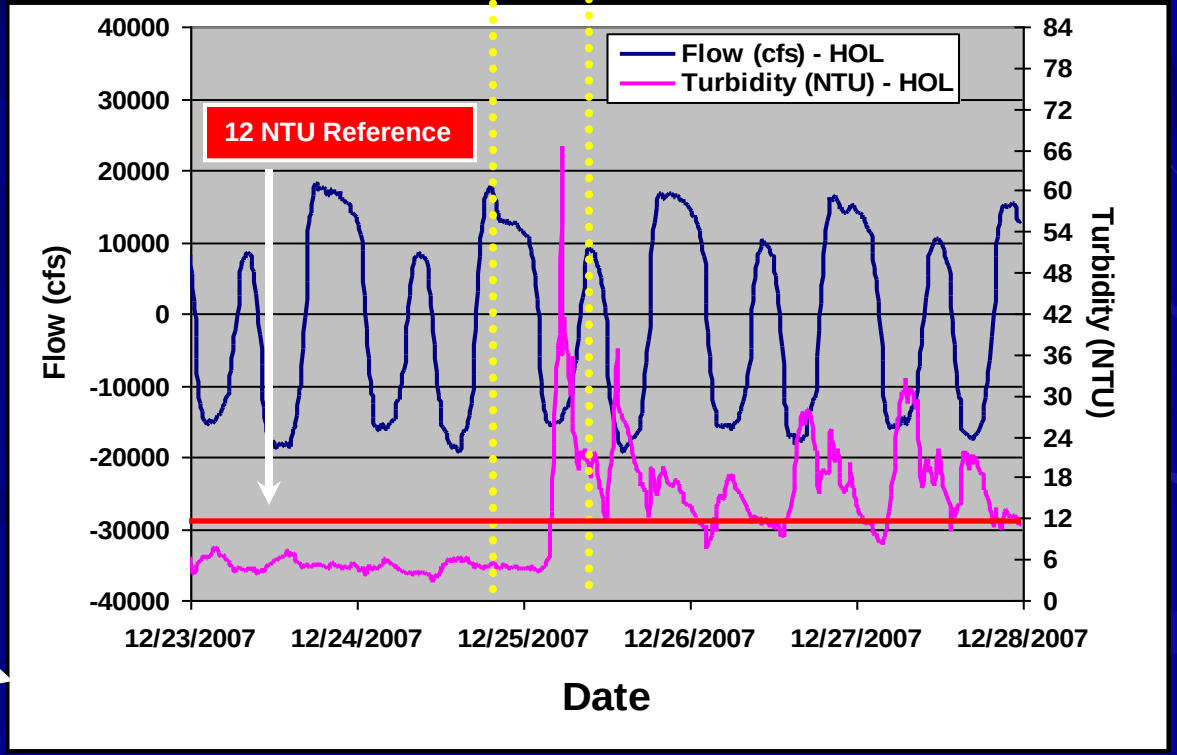
5. **Frank's Tract because of its shallow nature, is subject to mixing due to wind and wave action.**

- **Low tide event + wind-induced waves = Frank's Tract with thoroughly mix bottom sediments and re-suspension.**

Hourly Averaged Wind Speed Data collected at Ironhorse Sanitary District - December 24-25, 2007 Wind Event



Turbidity and Flow Data collected at Holland Cut near Bethel Island -December 24-25, 2007 Wind Event



Significant Findings

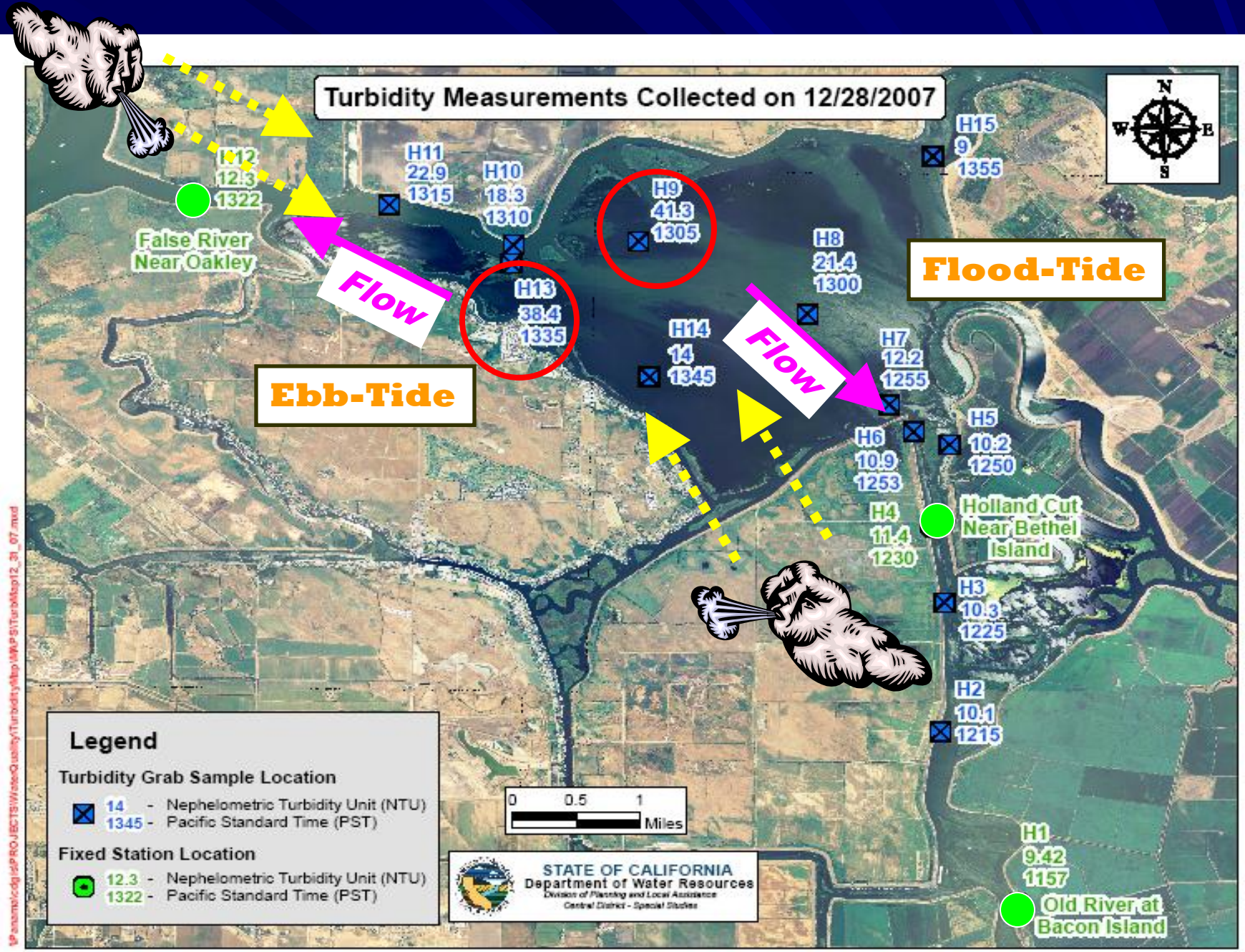
➢Onsite Investigation by Boat on December 28, 2007

- **HOL station was visited and the instrumentation was operating correctly.**

- **Discrete samples were taken using a HACH 2100P turbidimeter starting from Old River near Bacon Island, northwest through Franks Tract to False River near Oakley.**

- **Staff concluded that turbid conditions in Franks Tract is probably the source of the high turbidity readings at the HOL compliance station on December 25.**

- **Staff installed two new YSI 6136 optical turbidity probes on December 28 at False River near Oakley and Old River near Bacon Island.**


Turbidity Measurements Collected on 12/28/2007
H12
12.3
1322
False River
Near Oakley
H11
22.9
1315
H10
18.3
1310
H9
41.3
1305
H13
38.4
1335
H14
14
1345
H15
9
1355
H8
21.4
1300
H7
12.2
1255
H6
10.9
1253
H5
10.2
1250
H4
11.4
1230
Holland Cut
Near Bethel
Island
H3
10.3
1225
H2
10.1
1215
H1
9.42
1157
Old River at
Bacon Island
Flow
Flow
Flood-Tide
Ebb-Tide
N
W
E
S
Legend
Turbidity Grab Sample Location
14 - Nephelometric Turbidity Unit (NTU)
1345 - Pacific Standard Time (PST)
Fixed Station Location
12.3 - Nephelometric Turbidity Unit (NTU)
1322 - Pacific Standard Time (PST)
0 0.5 1
Miles
STATE OF CALIFORNIA
Department of Water Resources
Division of Planning and Local Assistance
Central District - Special Studies

Significant Findings

➢ Wind/Storm Event January 4, 2008

- The wind event caused average turbidity levels to increase considerably at all three stations.

HOL 7.16 NTU, OBI 5.39 NTU, and FAL 10.81 NTU.

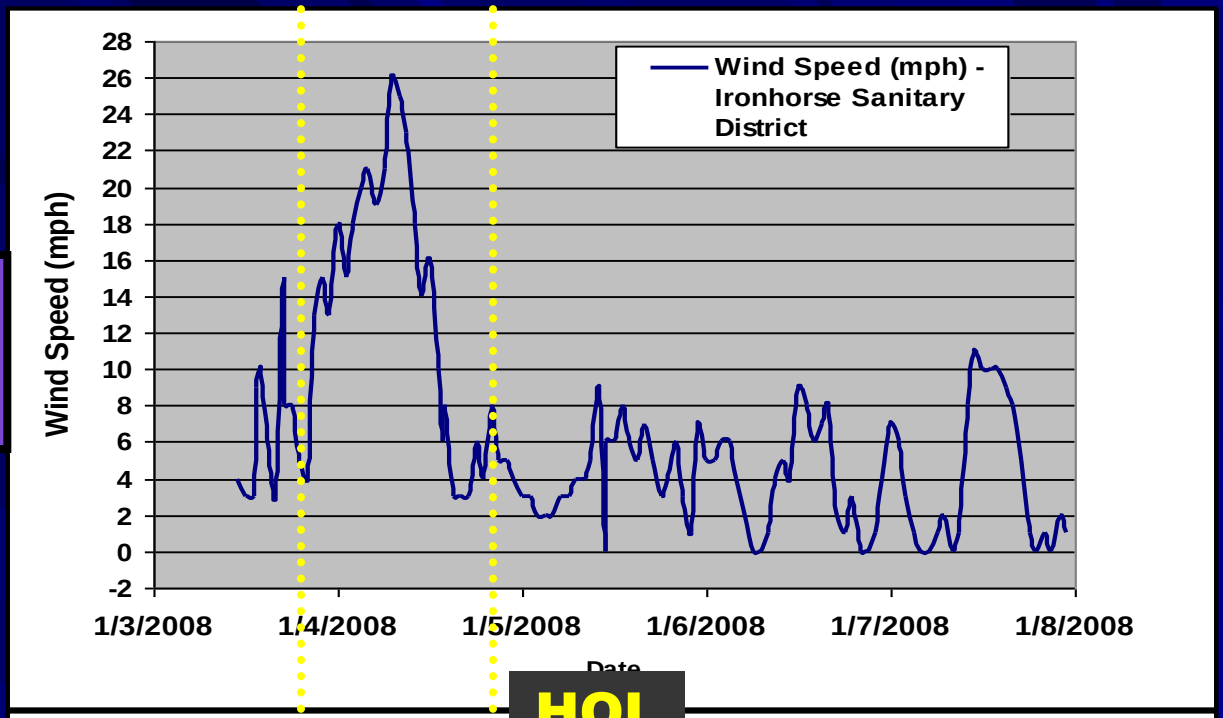
After December 25th

HOL 15.14 NTU, OBI 15.34 NTU, and FAL 29.34 NTU.

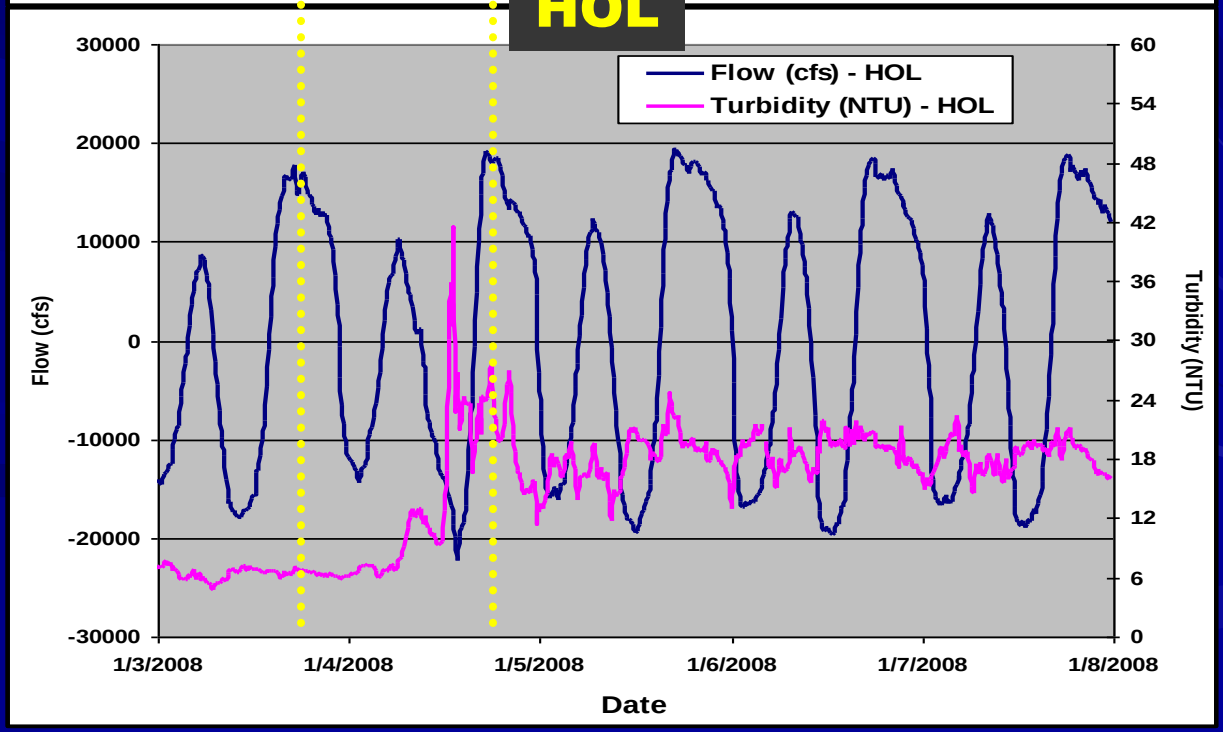
- Max at HOL = 41.20 NTU, FAL = 77.70 NTU

- Maximum hourly wind speed reached an average of 26 mph – from South East

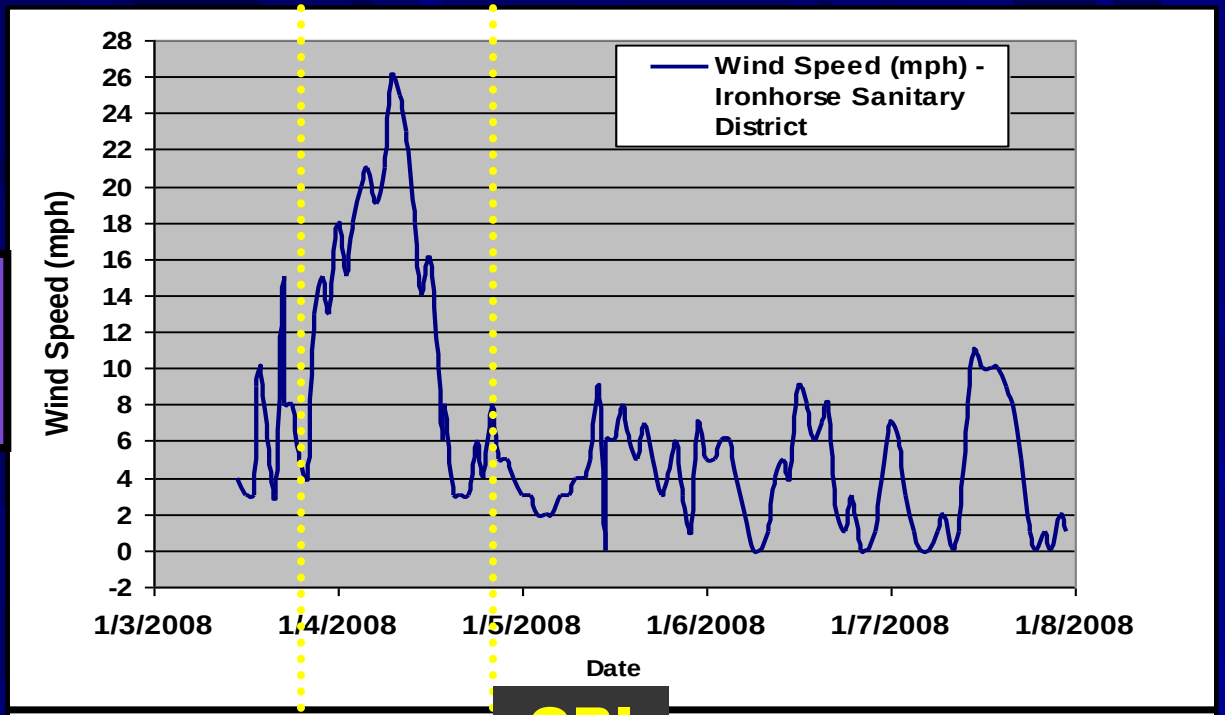
Wind Speed Data collected at Ironhorse Sanitary District January 4, 2008



Turbidity and Flow Data collected on January 4, 2008



Wind Speed Data collected at Ironhorse Sanitary District
January 4, 2008



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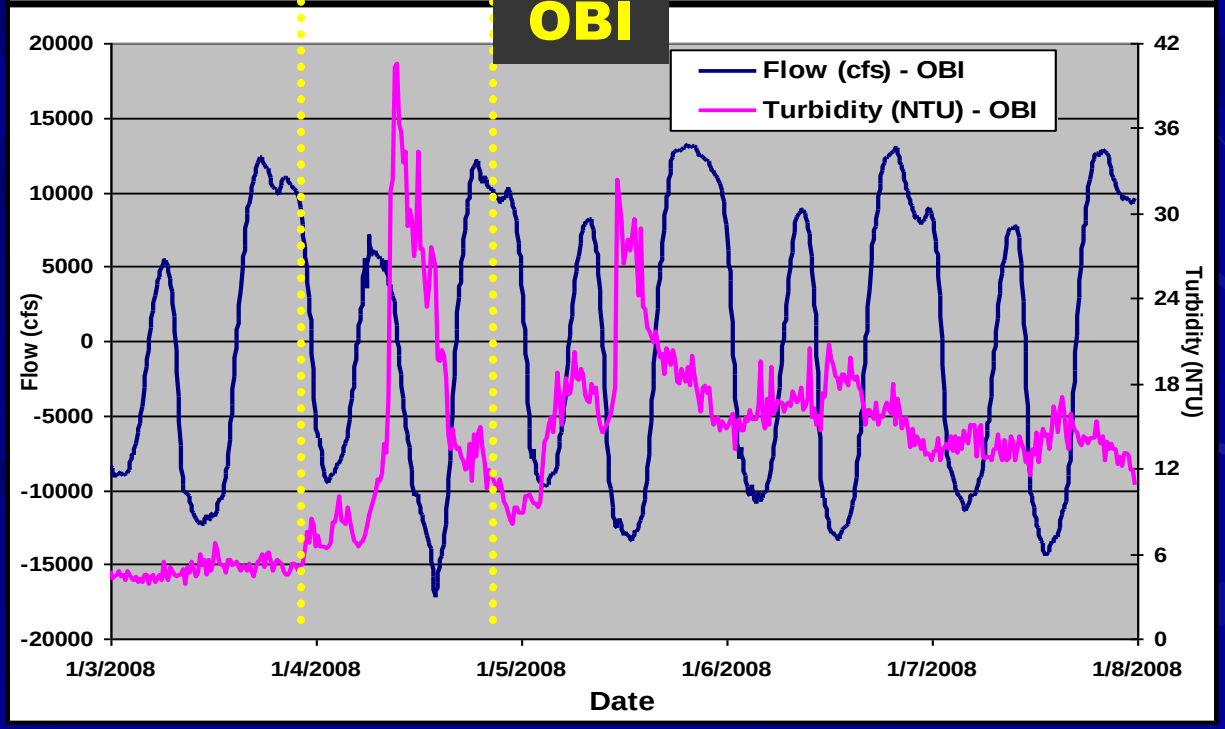

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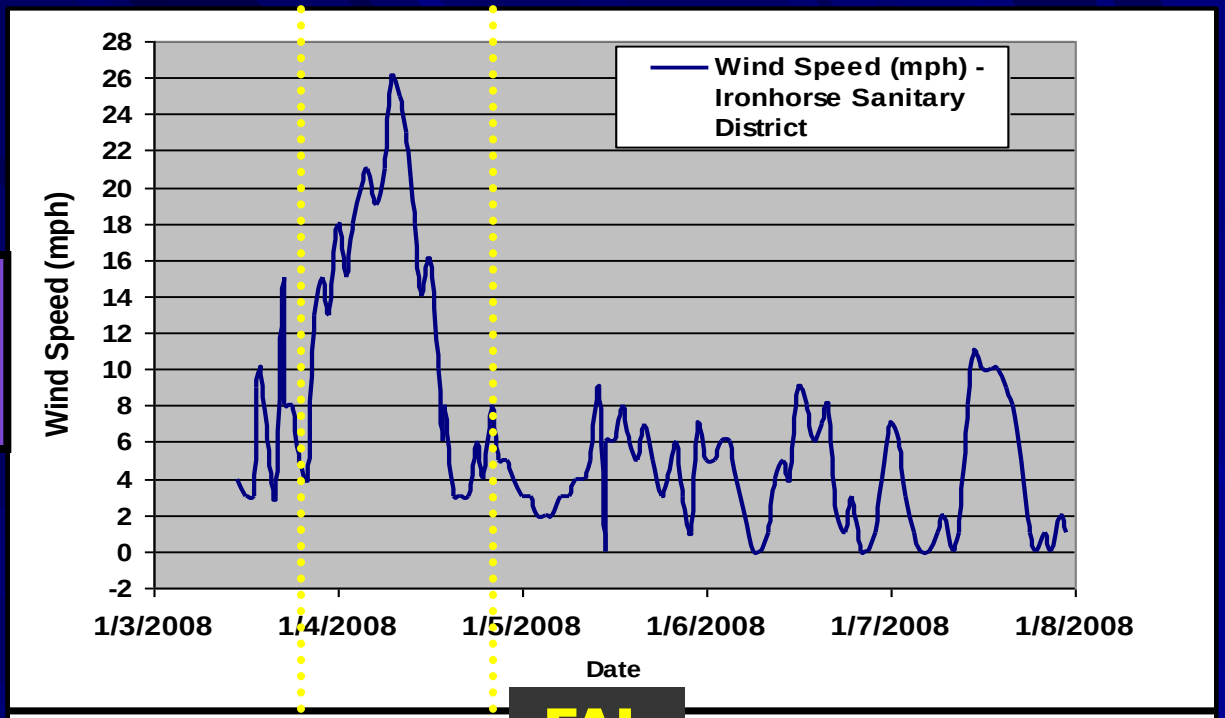

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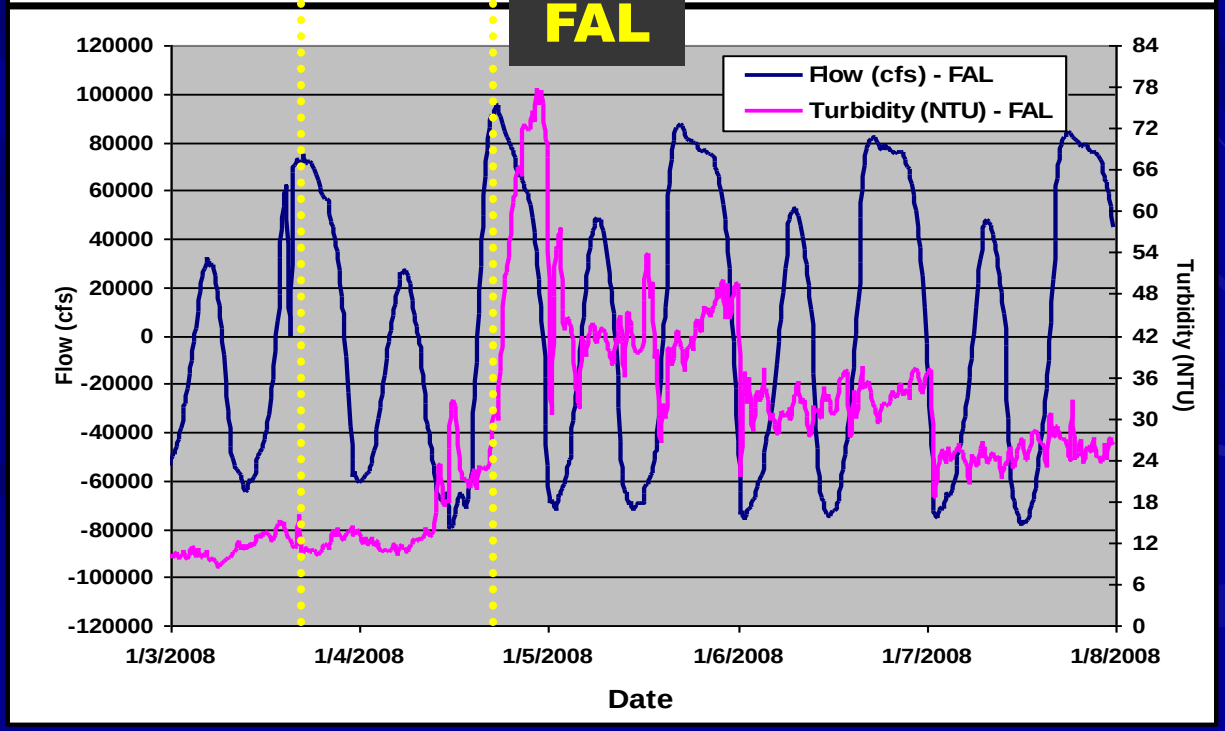
January 4, 2008



Data Summary

Based on DWR's continuous turbidity data

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The use of wind speed and direction data from Ironhouse Sanitary District

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The lack of turbid water entering Sacramento-San Joaquin Delta

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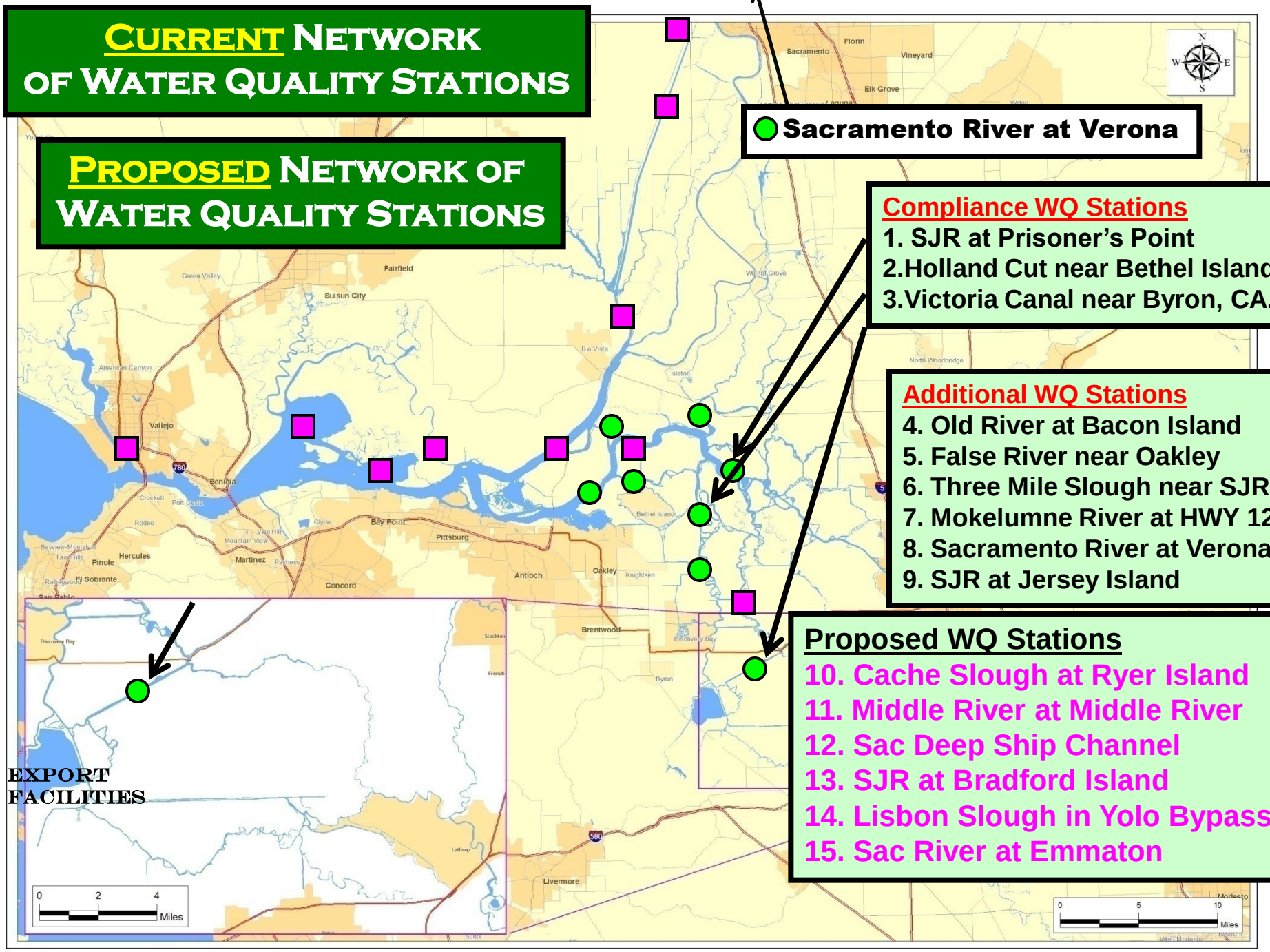
It seems highly probable that Franks Tract was the source of increased turbidity levels at all three of our monitoring locations.


Current Network of Water Quality Stations
Proposed Network of Water Quality Stations
Sacramento River at Verona
Compliance WQ Stations
1. SJR at Prisoner's Point
2.Holland Cut near Bethel Island
3.Victoria Canal near Byron, CA.
Additional WQ Stations
4. Old River at Bacon Island
5. False River near Oakley
6. Three Mile Slough near SJR
7. Mokelumne River at HWY 12
8. Sacramento River at Verona
9. SJR at Jersey Island
Proposed WQ Stations
10. Cache Slough at Ryer Island
11. Middle River at Middle River
12. Sac Deep Ship Channel
13. SJR at Bradford Island
14. Lisbon Slough in Yolo Bypass
15. Sac River at Emmaton
EXPORT FACILITIES
Sacramento
Florin
Vineyard
Elk Grove
Fairfield
Suisun City
Vallejo
Benicia
Martinez
Pittsburg
Bay Point
Concord
Antioch
Oakley
Brentwood
Byron
Livermore
Rio Vista
Isleton
Bethel Island
Walnut Grove
North Woodbridge
Discovery Bay
Lathrop
Miles

Project Recommendations

Increase Water Quality Monitoring throughout the Sacramento-San Joaquin Delta by:

Establishing the remaining 10 WQ stations recommended by staff from DWR, DFG, USGS, USBR, the State Water Contractors and The Delta Smelt Working Group.

First Priority:

COMPLETED

Second Priority:

- Cache Slough at Ryer Island
- Middle River at Middle River
- Sacramento Ship Channel
- San Joaquin River at Bradford Island
- Lisbon Slough in Yolo Bypass
- Sacramento River at Emmaton

Third Priority:

- Napa River at Mare Island
- Suisun/Grizzly Bay
- Honker Bay
- Suisun Gates